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Andy - FUI
what we've been
Waiting for

August 15, 2000

Mrs. Gwen Zervas
Case Manager
New Jersey Department of Environmental Protection (NJDEP)
Bureau of Federal Case Management
Division of Responsible Site Party Remediation
CN 028
Trenton, NJ 08625-0028

Subject: L.E. Carpenter & Company, Wharton, New Jersey
Work Plan to Evaluate Additional Technologies to Enhance On-Site Free Product Recovery
USEPA ID No. NJD002168748

Dear Mrs. Zervas:

RMT, Inc. (RMT) prepared this Work Plan on behalf of L.E. Carpenter and Company (LEC), per the July 31, 2000 conference call requests by the New Jersey Department of Environmental Protection (NJDEP) and the United States Environmental Protection Agency (USEPA Region II). This Work Plan addresses your comment letter of August 1, 2000, and expands on our Free Product Remedial Alternatives Analysis letter of May 15, 2000.

On May 15, 2000, RMT also reported on modeling of recoverable free product and remediation of the dissolved plume by natural attenuation (RNA). In the May 15 reports, RMT showed that dissolved phase constituents downgradient of the free product area can be remediated via RNA. We also recommended using the results of the RNA study to re-evaluate the required timeline for free product recovery. RMT showed that extraction of the on-site recoverable free product volume could not be accomplished with the proposed two-year time frame utilizing the current remedial method; monthly enhanced fluid recovery (EFR). However, because of the natural attenuation occurring, and lack of impacted receptors to contaminated groundwater, free-product recovery over a period longer than two years should be acceptable. Regardless of these results, NJDEP and USEPA have requested that LEC evaluate additional technologies to expedite removal of free product. Therefore, RMT prepared this Workplan to evaluate more aggressive free product remedial technologies.

The following sections present the pertinent site background, a discussion of the remedial alternatives selected for more detailed evaluation, and details how RMT will evaluate each alternative.

BACKGROUND

Subsurface investigation and remedial action activities have been ongoing at the former LEC facility since the Administrative Consent Order was executed in 1986. Free product removal was identified in the 1994 Record of Decision (ROD) as Phase 1 of remediation for site groundwater, to be followed by Phase II, recovery and treatment of dissolved constituents in the groundwater once the immiscible

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product layer was removed. Current dissolved phase contaminants of concern in the groundwater are benzene, toluene, ethylbenzene, and xylenes (BTEX), and bis (2-ethylhexyl) phthalate (DEHP). Based on the analytical results of free product sampling conducted by Roy F. Weston (WESTON) in February 1995, the free product layer is the major source of dissolved phase BTEX and DEHP contamination in shallow groundwater.

Free product recovery was initiated during the early 1990's, first with skimmer pumps in select wells, and then with enhanced fluid recovery (EFR) over a large number of wells in the free product zone. Since November 1997, RMT has been performing monthly EFR events from a network of 28 EFR wells by means of a mobile vacuum truck. Extracted free product and limited volumes of groundwater are transferred to an on-site 550-gallon aboveground storage tank for eventual transportation and disposal. Current and historical free product extraction volumes range from 50 to 60 gallons of measurable free product per EFR event (600 to 720 gallons per year). However, the total estimated volume of free product is approximately 44,000 gallons, of which only a fraction (8,000 to 13,000 gallons) is likely to be recoverable, based on experience from other sites (see USEPA publication EPA 510-R-96-001). RMT estimated that it would take 13 to 22 years to remove all of the recoverable volume of free product using monthly EFR. Nevertheless, we will re-evaluate EFR as part of this Work Plan by increasing the frequency of EFR events. This will result in a more detailed evaluation of free product recovery technologies. EFR may be a preferred technology when coupled with alternative enhancement (i.e. steam heating) and/or increased EFR event frequency.

The following options, were identified by RMT for further evaluation. We present details on how these evaluations will be conducted. RMT will recommend one alternative, consisting of either one single technology or some combination of the evaluated technologies, following agency acceptance and our completion of this Work Plan. LEC will subsequently implement the recommended remedial alternative following NJDEP and USEPA approval.

ALTERNATIVE NO. 1: IN-SITU CHEMICAL OXIDATION UTILIZING FENTON'S CHEMISTRY

1. Background

The May 15, 2000, letter entitled "Free Product Remedial Alternative Analysis" described the general chemistry and treatment approach utilizing Fenton's reagent to oxidize organic compounds in the subsurface. The first step to evaluate this approach for implementation at the L.E. Carpenter site is to conduct a bench-scale treatability study of product-saturated site soils. This treatability study, as proposed in the May 15 letter, would evaluate the effectiveness of using Fenton's chemistry to degrade free product in soil under laboratory conditions.

The August 1, 2000 letter from the NJDEP and USEPA requested a limited in-field pilot test and additional information regarding the in-situ chemical oxidation injection process. In response to these requests, this Work Plan details the proposed chemical-oxidation process, bench-scale treatability study, and pilot test.

2. In-Situ Chemical Oxidation Injection Process

In-situ chemical oxidation treatment typically involves the injection of hydrogen peroxide (oxidant), ferrous sulfate (catalyst), and a mixture of phosphoric and sulfuric acid (for pH adjustment). Potassium permanganate may be used as an alternate or supplemental oxidant depending on site-specific conditions.

The pH modifiers are used in the process to create a slightly acidic condition in the groundwater (i.e., a target pH range of 4 to 6), which helps solubilize ferrous iron. The ferrous iron reacts with hydrogen peroxide to form hydroxyl radicals and ferric iron. The hydroxyl radicals are capable of oxidizing a wide range of organic compounds, including the BTEX and DEHP present at the site. The hydroxyl radicals will react with the volatile organic compounds (VOCs) to produce carbon dioxide, chloride ions, and hydrogen ions. The pH modifiers (phosphoric and sulfuric acid) are typically neutralized over a relatively short distance downgradient of the targeted treatment area.

To facilitate subsurface treatment, injection wells are installed at appropriate locations and depths (typically determined by a pilot test) to effectively treat the VOC source area within the aquifer. The radius of influence for each well is determined through the pilot test but typically varies from approximately 8 to 20 feet to facilitate substantial VOC reduction effects. The chemical injection pressures are adjusted to safely and effectively deliver the chemicals into the subsurface. Typical injection pressures to address the LNAPL at the site may range from approximately 5 to 15 psi. The groundwater temperature in the immediate vicinity of the chemical injection area may increase from 1 to 15 degrees (F) as a result of the exothermic chemical reaction. Vent wells are typically installed (if not available at the site) to relieve gas pressure generated during the chemical injection process. The specific quantities and types of reagents used will be determined through the treatability study and pilot test. In-situ chemical oxidation injection processes typically replace on the order of two pore volumes of the targeted treatment volume of aquifer.

For application at the L.E. Carpenter site, in-situ chemical oxidation would likely be conducted after enhanced free product removal (e.g., through multiphase extraction, steam-enhanced product removal, etc.) has effectively reduced the LNAPL layer thickness. Experience at similar sites indicates that this is a more cost-effective and safe approach to address relatively thick zones of floating free phase product.

Bench-scale Treatability Study Design

The objective of the treatability study will be to evaluate the effectiveness of Fenton's reagent (ferrous iron plus hydrogen peroxide) to degrade the constituents of concern (i.e., free phase product containing BETX and DEHP). A total of two saturated soil samples will be collected from within areas of free product at the site. The samples will include varying soil types (fine-grained and sandy soils) that are saturated with the product. The bench-scale test will consist of mixing the soil with various proportions of reagents (that constitute Fenton's reagent) in beakers and observing the results of the oxidation reaction. The bench-scale study will be conducted at RMT's Treatability Testing Laboratory (Madison, Wisconsin). The concentrations of VOCs and semivolatile organic compounds (SVOCs) for the soil samples will be determined before and after the treatability test by En Chem Analytical Laboratories (Madison, Wisconsin). The results of the treatability study will be presented to the NJDEP and USEPA in a separate letter report that will include recommendations for the pilot scale study, if deemed appropriate. The details of the pilot test are presented in a following separate section.

ALTERNATIVE NUMBER 2: FRENCH DRAIN/RECOVERY TRENCH

Whereas chemical oxidation (described above) is an *in-situ* remedial technology used to remove free product, other collection and extraction technologies could physically recover free product more effectively from the subsurface. Evaluation of collection trench/french drain methodology is proposed, because free product tends to accumulate more readily within a more permeable trench than within less permeable native subsurface soils, thereby enhancing collection and extraction. Trenches have considerably more surface area than well points through which free product may flow, which also can enhance the rate of recovery. RMT will prepare a conceptual design of collection trenches that will bisect the free product plume and maximize recovery rates.

Maximizing product recovery from the area surrounding the trench is directly related to the amount of influence (pressure gradient) the extraction technology utilized to remove the product from the trench can induce. A recovery trench generally operates at atmospheric pressure, inducing flow of product and water by lowering the water table. Alternatively, a vacuum can be applied to horizontal well screens placed in the trench, utilizing multi-phase extraction methods to maximize the removal of product and vapor, and minimizing the extraction of groundwater. By placing well screen at multiple levels in the trench, adjustments can be made for seasonal fluctuations in the water levels by pumping from the appropriate well screen. If a vacuum is to be applied to the extraction trench, the trench must be effectively sealed from the surface with a low-permeability cover. However, fluctuations in the water table and product layer can present difficulties and reduce the efficiency of the system when maximizing product recovery while minimizing groundwater recovery is the prime objective. As a result, the feasibility analysis of a recovery trench will incorporate various design considerations to maximize the recovery of free product and minimize groundwater recovery. Trench design considerations will include, but are not limited to surficial trench liners/trench caps to maintain efficient vacuum and maximize the capture zone, and multiple vertical screened intervals within the extraction sumps/risers to compensate for fluctuating water table elevations. Various extraction methods will also be evaluated for use within the trench system. These will include, but are not limited to skimmer pumps, submersible pumps, belt skimmers and liquid ring pumps, or various combinations.

is it all that model...

RMT will use a simplified single layer groundwater flow model that simulates the effects of a trench collection system on free product recovery rates to estimate the extent of the capture zone of the trench given various design considerations. We will incorporate site-specific hydraulic data and boundary conditions into the simulation to allow for a representative model of the site to be constructed. We will use the model to predict the rate of recovery and the expected project duration under each design based on the estimated recoverable volume of free product at the site. The model will also be useful in evaluating the conceptual design of the extraction trench system.

Although the design will focus on recovery of free product, production of an unknown volume of extracted groundwater will likely occur. Therefore, this study will also address product/water separation, groundwater treatment, disposal and discharge, trench soils, and corresponding permit issues.

ALTERNATIVE NUMBER 3: MULTIPLE-PHASE EXTRACTION WITH WELL POINTS

Multiple-phase extraction (MPE) is an *in situ* technology that uses a single, high-vacuum pump to extract liquid and vapor simultaneously from the subsurface. Extracted liquid and vapor are treated and disposed, or discharged. The vacuum applied to the subsurface with MPE systems creates vapor-phase pressure gradients toward the vacuum well. These vapor-phase pressure gradients are also transmitted directly to the subsurface liquids, which will flow toward the vacuum well in response to the imposed gradients. The higher the applied vacuum, the larger the hydraulic gradients that can be achieved in both vapor and liquid phases and thus, the greater the vapor and liquid recovery rates.

Several extraction wells would be connected to a single high-vacuum pump, usually a liquid-ring vacuum pump capable of producing over 400 inches water column (in. H_2O), or 29 inches mercury (in. Hg) vacuum. In each well, an extraction tube (also known as a "spear" or "stinger pipe") is installed with its tip at the elevation to which drawdown of the groundwater is to occur. The extraction tubes are connected to the vacuum pump via manifold piping. Because the vacuum that is applied induces a substantial pressure gradient to the well, product flow to the well will be significantly enhanced, compared to pumping liquids only from a well. MPE can be significantly more effective in product recovery than pumping liquids only, in lower permeability formations, such as the upper stratum of silty sand and sandy silt at this site.

It is important to minimize the amount of groundwater that would be extracted, while maximizing the amount of product extraction. Adjusting the amount of vacuum applied to the well, which causes upconing of the water table, with the elevation of the stinger pipe, can effectively balance the upconing/drawdown effects, and prevent smearing of the product in the formation. In this way, product recovery can be maximized and groundwater extraction is minimized.

Within the free product area, the MPE extraction system would be connected to multiple wells. If judged feasible, the existing EFR wells could be used; alternately, additional wells might be installed specifically for this purpose. Multiple liquid ring pumps would be connected to the extraction wells, downstream of a primary knockout tank/air water separator. Placement of the liquid ring pumps downstream of the primary knockout tank/air water separator would prevent the liquid ring pumps from direct contact with the fluids, thus avoiding the historical pump maintenance problems associated with pumps at the site that came in contact with the product.

Recovered product would be temporarily stored in an on-site staging area and later removed from the site for disposal. The extracted groundwater would likely be treated on site with an appropriate technology that is to be determined. Treated groundwater would then need to be disposed, either through an infiltration gallery, injection well(s), surface water, or the sewer system. Appropriate permits for disposal of treated groundwater would need to be obtained, with assistance from the USEPA and the NJDEP.

RMT will evaluate the MPE well system using a groundwater flow model of the site to estimate the zone of capture of each extraction well. We will input site-specific hydraulic conductivity data and boundary conditions into the model to evaluate the capture zone of the wells under various levels of vacuum, so that we can estimate the appropriate placement and number of wells. This analysis will provide a sufficient amount of information to evaluate the feasibility of using MPE with extraction wells at the site.

EFR AND ALTERNATIVE NO. 2 AND 3
ENHANCEMENT METHODOLOGIES

As part of this free product remedial technical evaluation, we will also evaluate other innovative technologies involving heating and soil flushing processes to remediate the source area. As previously mentioned, these technologies will be evaluated as enhancements to Alternative 2, 3, and EFR. Based on preliminary research, we have identified the following technologies as potential options to enhance the remediation of the source area at LEC:

Steam Heating of Soil

Steam heating of soil uses steam to heat the soil that contains free product, thereby decreasing the viscosity and increasing the mobility of the free product for extraction in a recovery system. The steam is either generated in a boiler at the surface of the site or imported from an adjacent facility that produces steam. By heating the soil significantly (but below the boiling point of water) the mobility of viscous liquids can be enhanced thus increasing rates of free product recovery and extraction. . A limited pilot test to evaluate the potential benefit of using steam heating of soil to enhance free product recovery will be conducted, as described below.

Radio Frequency Heating of Soil

Radio frequency (RF) heating uses electromagnetic radiation to heat soils *in situ*. RF heating is used in conjunction with SVE or MPE to volatilize and recover contaminants faster than with SVE or MPE, alone. Remediation time is also decreased when RF heating is used in conjunction with product recovery: by heating, the soil viscosity of the product is decreased, increasing its mobility and potential for recovery via pumping and vapor extraction.

Six-Phase Soil Heating

In six-phase soil heating (SPSH) the soil is also heated *in situ*. SPSH heats the soil using electrical energy induced into the subsurface through electrodes that are installed in wells. Similar to RF heating, SVE or MPE would be used in conjunction with SPSH at the LEC site to decrease the source area remediation time.

Cosolvent or Surfactant Flushing

Flushing involves the injection a solvent mixture or surfactant *in situ* to mobilize the product at the site for recovery. Soil flushing used in conjunction with a recovery system (using trenches or wells) at the site may significantly reduce the remediation time of the source area as compared to using a free product recovery system alone.

A detailed evaluation will be performed on each of the above technologies to determine if any of these technologies may be feasible and cost-effective to enhance remediation of the source area at LEC. Our evaluation will include:

- Researching current technology literature
- Researching and evaluating case studies, including bench scale, pilot scale, and full scale technology implementation and cost. RMT will review case studies from the USEPA database, RMT projects, and from literature.
- Evaluating the technical feasibility to implement the technology at LEC, based on the site hydrogeology and free product extent
- Interviewing technology vendors and consultants who have implemented the technology
- Estimating a cost to implement the technology at the site, as an enhancement to free product recovery

The results of evaluation of these alternative enhancements will be included in the free product technical evaluation report. The merits of enhancing free product recovery through soil heating (using steam) will be assessed during a limited pilot scale test that is outlined below. Although steam will be used in the pilot test for heating the soil, the results will be useful for evaluating whether soil heating in general, regardless of the technology employed to heat the soil, enhances free product recovery significantly. We will not perform bench and pilot scale testing of the other listed "enhancement" technologies as part of this technology evaluation. Rather, RMT will perform such testing as part of the remedial action pre-design if we chose it to be part of the recommended alternative. If RMT determines that bench and/or pilot tests are appropriate, then we will include estimated costs in the cost for each technology.

LIMITED PILOT TEST

A limited pilot scale test of multi-phase extraction, steam-enhanced multi-phase extraction, and (potentially) chemical oxidation will be conducted as part of this Work Plan. The first phase of the pilot test will be to use multi-phase extraction (MPE) alone, and then in conjunction with steam heating of the soil, to recover free product from a portion of the site. If sufficient free product can be removed during this first phase to make it feasible, and if the bench-scale study of chemical oxidation indicates its feasibility, chemical oxidation will be employed as a measure to remove smaller volumes of free product that would not readily flow to the recovery system. Details of the MPE, steam-enhanced MPE, and chemical oxidation portions of the pilot scale test are outlined below.

1. *Multi-Phase Extraction*

A multi-phase extraction well will be installed and tested for effectiveness in recovering free product. Figure 1 shows the layout of the MPE well, monitoring wells, and soil vacuum/vent monitoring wells located in the western portion of the LEC site in one of the thicker areas of free product. RMT would construct the MPE well of 6-inch diameter steel casing and a 10-foot long stainless steel screen, installed to a depth of approximately 8 feet below the water table. Monitoring wells already in place would be utilized, including nearby wells EFR-21, EFR-28, and WP-A6, which are within approximately 30 feet of the proposed MPE well. Additional more distant monitoring wells that may be monitored during the test for water levels and vacuum include EFR-1, EFR-20, EFR-18, and WP-A4. Vent wells V-1, V-2, and V-3, which will be used to vent soil vapors during the chemical oxidation portion of the pilot test (if conducted), will be sealed during the MPE test and used as soil vacuum monitoring points.

The MPE well will be configured with a "stinger" pipe that is of small (approximately 1 inch) diameter to fit inside the MPE well and extend through the free product zone in the well. The placement of the stinger will be adjusted to maximize recovery of free product while minimizing groundwater recovery. A liquid ring vacuum pump will be used to extract free product and soil vapor during the test. A vacuum of approximately 20 to 25 inches of mercury will be created with the liquid-ring pump, inducing flow of free product and soil vapor to the MPE well. The well will be sealed from the atmosphere to maintain the vacuum.

The MPE test will be conducted for up to 48 hours or until conditions such as rate of free product recovery reach a state of relative equilibrium. The rate of free product recovery, vacuum in monitoring wells and MPE well, water and product levels in the monitoring wells, and vapor concentrations in the vacuum pump exhaust stream, will be monitored before, during, and after the test at regular intervals. The results of the MPE well testing, including rate of free product recovery and apparent product thickness in wells before and after recovery, will be compared with these same parameters during steam-enhanced MPE (described below) to evaluate the effectiveness of the MPE alternative.

2. *Steam-Enhanced Multi-Phase Extraction*

Following the completion of the MPE testing, and attainment of an equilibrium rate of product recovery, steam will be injected into the soil to test whether this technology will increase rates of free product removal from the aquifer. Steam will be injected through a system of 3 injection points, shown on Figure 1. The steam will be injected under sufficient pressure to achieve a substantial heating of the soil, optimally up to approximately 80 degrees centigrade, in the area around the injection points. The steam will be generated on the surface of the site using a portable boiler.

The MPE system will continue operating as steam is injected for a period of up to 5 days, and rates of product recovery will be measured regularly. The temperature, water and product levels, pressure at each of the adjacent monitoring wells (minimum of 6 wells), and vapor concentrations in the vacuum pump exhaust system, will be monitored before, during, and after the test is completed.

The rate of free product recovery will be measured frequently during the test, and this rate will be compared to that of MPE alone, to assess the potential benefits of enhancing free product recovery using steam heating of the soil.

3. *Chemical Oxidation*

If the results of the bench-scale treatability study demonstrate that Fenton's chemistry is effective in degrading the free-phase BTEX and DEHP concentrations under laboratory conditions, then a pilot-scale chemical oxidation injection test may be performed. Our decision to conduct the pilot test will depend on whether the thickness of free product in the selected test site is reduced sufficiently following completion of the MPE and steam-enhanced MPE pilot tests. This decision is necessary so that we can conduct the chemical oxidation pilot test with an appropriate level of safety. The objective of the pilot study is to demonstrate treatment effectiveness of chemical oxidation in the field by reducing the observed thickness of the product layer.

Figure 1 illustrates the conceptual design of the pilot test. The selected test area is located at the upgradient end of the LNAPL zone to facilitate performance monitoring and site access for the drilling rig. An estimated total of three injection wells and three vents will be installed to treat an approximate 30-by-30 foot area of the LNAPL aquifer. The injection wells will be constructed of black iron pipe and installed approximately 15 to 20 feet below the ground surface (bgs) and screened across the LNAPL layer. The vent wells will be constructed of 2-inch PVC pipe and installed approximately 10 feet bgs and screened across the unsaturated soil layer. The surrounding well network (i.e., EFR wells 18, 20, 21, and 28, and well point WP-A6) will be used to monitor the performance of the pilot test.

RMT would conduct this test by injecting the reagents into the subsurface through injector wells under a pressurized delivery system. The vent wells are used to relieve gas pressure generated during the chemical injection either passively or with an applied vacuum. The specific type and amount of reagents comprising Fenton's reagent that will be injected for the pilot test will be determined from the bench-scale treatability study. During the injection, the gas pressure, chemical injection pressures, and several groundwater indicator parameters are monitored at surrounding wells.

Performance monitoring will be conducted to evaluate the effectiveness of the pilot test and to assess potential short-term and long-term impacts to the natural biodegradation of the constituents of concern (COCs) in the dissolved phase of the plume. To evaluate treatment effectiveness, the five wells identified above will be used to measure the thickness of the LNAPL immediately before, during, and then 2 and 4 weeks after treatment. The pilot test will be coordinated with the monthly product recovery efforts to allow treatment and performance monitoring.

To assess the potential short-term and long-term impacts to natural biodegradation of dissolved COCs in the aquifer downgradient of the treatment zone, dissolved oxygen, temperature, redox potential, and iron will be measured in 7 nearby monitoring wells (EFR wells 1, 20, 28, 19, and 21, and monitoring wells WP-A4, and WP-A6. A minimum of three rounds of monitoring of these wells will occur, including one round before chemical oxidation begins, and two rounds after it is completed, within approximately two weeks. The data will be evaluated to assess potential impacts to the ongoing biodegradation of the dissolved COCs after treatment and in the long-term.

The results of the pilot test and performance monitoring will be summarized in the "Enhanced Recovery Evaluation Report", and will be used to develop and evaluate alternatives for free product remediation.

TECHNOLOGY VS. COST AND IMPLEMENTABILITY

During implementation of this Work Plan, we will evaluate several technologies simultaneously. Figure 2 presents a flow chart that shows the various tasks and decision points that will be part of this evaluation. Associated costs to implement each technology will be evaluated based on the technical information determined through initial evaluation, laboratory analysis, modeling, and/or pilot testing. If a technology is determined to be economically infeasible during preliminary evaluations, it will be removed from further evaluation. For example, if *in-situ* chemical oxidation is determined to be effective in a laboratory setting, but excessive reagent volumes would be required for adequate free product remediation, we would not consider it for further evaluation based on cost. This method will be critical in choosing a technology that is effective from remedial, timeframe, and cost standpoints.

TECHNOLOGY EVALUATION REPORT

RMT will present the results of each free product remedial option evaluation in a concise report that will include the following information:

- A discussion of the methodology behind each option
- A discussion of the results of any modeling and/or testing performed to provide insight into option viability
- An outline of the potential recovery rates and estimated time frames associated with product removal under each option
- An evaluation of cost estimates for each option
- A recommendation regarding the remedial technology deemed most appropriate for implementation

LEC requests that, following your receipt of this Workplan, your review and approval of the Workplan be expedited, so that the work can begin as quickly as possible. If appropriate, we can arrange a conference call to resolve any remaining questions or concerns on the Work Plan. The Work Plan has expanded in scope based on your comments regarding additional technologies to evaluate in conjunction with those we have previously discussed. This may require that we increase the 90-day schedule to account for the time needed to conduct the pilot test procedures as discussed in the preceding sections and outlined in Figure 2.

Sincerely,

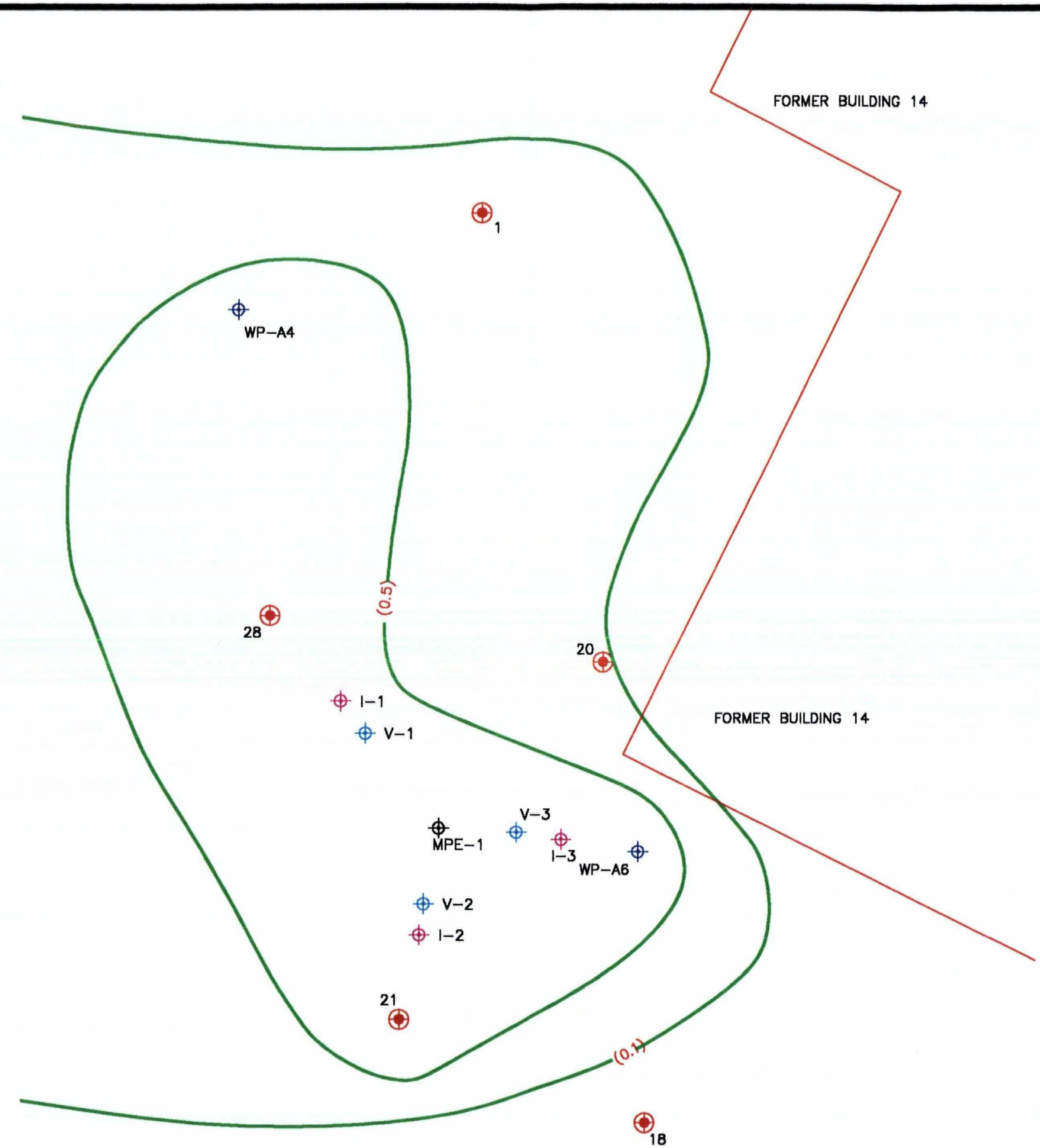
RMT, Inc.

Nicholas J. Clevett
Project Manager

Attachments: Figure 1: Conceptual Pilot Test Field Layout
Figure 2: Flow Chart for Evaluation of Technologies to Enhance Recovery of Free Product

cc: Cris Anderson, LEC
Steven Cipot, USEPA
Jim Dexter, RMT
Galen Kenoyer, RMT
Jack Anderson, RMT
Central Files (2)

Figure 1
Conceptual Pilot Test Field Layout



LEGEND

	WATER FEATURE
	PROPERTY LINE
	FENCE
MW-21	MONITORING WELL
13	ENHANCED FLUID RECOVERY WELL
WP-B7	WELL POINTS
GEI-21	PIEZOMETERS
(0.1)	LNAPL "TRUE THICKNESS" CONTOUR (FEET)
I-1	INJECTOR POINT
MPE-1	MULTI-PHASE EXTRACTION WELL
V-1	VAPOR VENT WELL

NOTE:
LOCATIONS OF INJECTOR POINTS, MULTI-PHASE EXTRACTION WELL, AND VAPOR VENTS WELLS MAY BE ADJUSTED BASED ON FIELD CONDITIONS.

CONCEPTUAL PILOT TEST
FIELD LAYOUT
LE CARPENTER
WHARTON, NEW JERSEY

RMT

DWN. BY:	BOERSMAP
APPROVED BY:	
DATE:	AUGUST 2000
PROJ. #	3868.21
FILE #	38682111.DWG

FIGURE 1

Attached Xref's: No xref's Attached.

$$PLOTTER$$
$$SCALE$$
$$ROT$$
$$SYTIME$$

$$DWG$$
$$USER$$
$$PRF$$
$$PTABLE$$

Figure 2
Flow Chart for Evaluation of Technologies to Enhance Recovery of Free Product

FIGURE 2. FLOW CHART FOR EVALUATION OF TECHNOLOGIES TO ENHANCE RECOVERY OF FREE PRODUCT